

## Report on cluster investigation: Cowlitz perinatal deaths Jan-Mar 1999

### *Cluster Investigation Team:*

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### **Overview**

In response to community concern about a possible excess of infant deaths for the first three months of 1999 in Southwest Washington, we conducted an investigation to determine whether a cluster of deaths was existent. We determined that the apparent elevations in infant and fetal deaths, seen with examination of published obituaries, were understandable in terms of variation due to known factors: normal variation in annual occurrence, and known fluctuations in reporting of early fetal deaths. We plan a follow-up study to examine the first six months of data, later this year. Infant and fetal deaths are tragic losses for the family and the community. We support the wide range of public health programs aimed at promoting healthy mothers and healthy babies.

### **Background**

The initial request for assistance was made by Allan Brettman of the Daily News in Longview, to Ann Lima at Washington State Department of Health (DOH) Center for Health Statistics, on 16 April 1999. He reported that the librarian for the newspaper, who enters information from obituaries into a database, had noted an increase in infant deaths in the first three months of 1999. The reporter requested information on infant and fetal deaths for seven counties in SW Washington. Ms Lima provided copies of selected Vital Statistics summaries from 1970-97, as well as a copy of the Deaths CD-ROM, and referred him to DOH Maternal and Child Health (MCH) Child Death Review staff (Melissa Allen) and to SW Washington Health District assessment staff (Melanie Payne, Bonnie Kostecky).

Infant and fetal deaths are considered by DOH and Cowlitz County Health Department (CCHD) to be tragic losses for the family and the community. The public health response consists of academic public health research, to find unknown causes, and prevention programs, to target known causes. Both DOH and CCHD invest considerable resources and staff time to improve and promote healthy pregnancies. Examples of MCH programs to promote community health include: those which affect the "preconceptional" period, such as promotion of use of folic acid supplementation, and traditional family planning; those which affect pregnancies, such as early prenatal care, First Steps, maternity case management, promotion of nutrition through the Women, Infants and Children (WIC) program, and appropriate labor and delivery care; and, those affecting the "post-partum" period, such as newborn screening, well child follow-up, the "back-to-sleep" campaign,

and immunizations. These programs rely upon active partnerships between governmental health agencies and community members.

Over the past decade, there has been a steady decline in the infant mortality rate statewide, from over nine deaths per 1,000 births to under six infant deaths per 1,000 births (Figure 1). The fetal death ratio over the period has remained fairly constant, between five and six fetal deaths per 1,000 births (Figure 2).

### **Formation of the Cluster Investigation Team**

After discussions with DOH MCH epidemiologist Cathy Wasserman and Acting State Epidemiologist Juliet VanEenwyk, a Cluster Investigation Team was established on 27 April, consisting of DOH staff and the health officers in the counties of concern. DOH staff were: Steven Macdonald of Office of Epidemiology, Jim Gaudino of MCH epidemiology, and Vicki Sussman of MCH Child Death Review. County health officials were: Karen Steingart (for Clark, Skamania, Wahkiakum, and Cowlitz), Diana Yu (for Lewis), Frank Hing (Pacific), and Larry Jecha (for Klickitat). Because Mimi Fields replaced Dr Steingart for Cowlitz, she was soon added to the team. A consensus emerged from consultations with the local health officials that DOH should take the leadership role in the investigation, due to the multi-county nature of the concern. Dr Macdonald was named to lead the team.

On 5 May, discussions between Dr Macdonald and the reporter resulted in narrowing the area of concern to two counties, Cowlitz County WA and Columbia County OR, because it seemed that the concern focused on Cowlitz as the county of occurrence or residence. MCH epidemiologist Ken Rosenberg of the Oregon Health Division was contacted to aid in the investigation. The Cluster Investigation Team was then reduced to four individuals: Dr Macdonald, Dr Gaudino, Ms Sussman, and Dr Fields.

### **Case definition**

The first task for the team was the establishment of a case definition. One consideration of central importance was the ability to compare the observed count of cases to an expected number, based on analysis of existing data.

The following case definition was proposed on 5 May. Subsequently, it was found that the number of cases related to Columbia County was limited. This case definition was adopted on 12 May:

#### *Case series 1.*

Age period: Infant death  
County: Cowlitz  
Place of: Residence  
Time period: 1/1/1999 to 3/31/1999

#### *Case series 2.*

Age period: Fetal death  
County: Cowlitz  
Place of: Residence  
Time period: 1/1/1999 to 3/31/1999

It was recognized that the case definition of fetal death might prove problematic, due to variable reporting of early fetal death, and the decision was made to stratify the fetal deaths by gestational age, if the number of observed fetal deaths were found to be elevated over that expected.

Fetal death reporting varies across geographical areas, as well as over time. The reasons for this variation are complex. At any given time and place, there are fetal deaths for which we expect to see a certificate, and those for which we do not. First, some fetal deaths may occur much earlier in the pregnancy than the legal cut-point, and would not be reportable nor result in completion of a fetal death certificate under any circumstances. Second, some fetal deaths may occur at roughly 20 weeks gestation. At that point, there is often considerable uncertainty about the exact gestational age, since clinical estimates may vary, depending on whether the clinician uses one or more of three sources of information: the date of the woman's last menstrual period, or a date reported by the woman to be the presumed date of conception, or ultrasound examination results (and a date is only inferred from physical measurements during ultrasound); if the clinician uses more than one source of information, resolving a discrepancy in dates can be a challenge. Because of this uncertainty, the clinician may judge that the fetus is less than 20 weeks gestational age, does not meet the legal requirement for reporting, and thus no fetal death certificate is completed.

This clinical judgement is not uniform and standardized among physicians, so two different physicians may come to different conclusions when faced with the same circumstances. Similarly, the same physician may vary at different points in time: clinical judgement evolves with experience. However, when a pregnancy has progressed to 28 weeks, there is seldom any doubt about whether the legal reporting requirements have been met. Thus variation in fetal death reporting is much greater in the 20-27 week gestational age category than it is in the 28+ week category.

### **Use of existing mortality data**

A preliminary analysis of published data was made in early May. Ten years of data were reviewed from the DOH Vital Statistics reports on infant and fetal deaths, and those data were used to project forward to the first quarter of 1999. The counts of 1999 Cowlitz infant and fetal deaths originated from the obituaries sent by Mr Brettman (and not yet confirmed at that time [refer to the next section for more information on the process of case ascertainment and confirmation]). Expected numbers were calculated based on annualized 1988-97 county data; to obtain a three-month expectation, annual numbers were divided by four.

For infant death, Cowlitz had a slightly elevated infant mortality rate in 1988-97: 8.3 vs. 6.99 for the state as a whole, expressed in units of infant deaths per 1,000 births; this difference was not statistically significant. There was considerable year-to-year fluctuation in county numbers, which ranged from 6 to 14 in the ten-year period (Figure 3). The six [unconfirmed] infant deaths in the first three months of 1999 was somewhat

greater than expected (2.3 times that of the prior ten-year period; this difference was not statistically significant).

For fetal death, Cowlitz had a slightly lower fetal death ratio in 1988-97: 4.2 vs. 5.52 for the state as a whole, expressed in units of fetal deaths per 1,000 births; this difference was not statistically significant. There was considerable year-to-year fluctuation in county numbers, which ranged from 1 to 9 in the ten-year period (Figure 4). The two [unconfirmed] fetal deaths in the first three months was slightly greater than expected (1.5 times that of the prior ten-year period; this difference was not statistically significant).

[*Technical note.* Cowlitz County differs from the rest of the state in one important way: the number of births in the county has remained fairly constant over the past decade, whereas the number of births statewide has increased. As a result, it is valid to look solely at counts of deaths in Cowlitz, since count data is equally informative as rate data in this instance. When comparisons are made to the state as a whole, or when statewide trend data are examined, the differences in births must be taken into account by the mechanism of calculation of rates (or, in the case of fetal deaths, what is termed a “ratio”, though it is calculated in the same fashion).]

### **Case confirmation**

The team had initially hoped that the list of 16 names (14 with published obituaries) forwarded by Mr Brettman could be compared to the names compiled for the Early Notification of Childhood Deaths (ENCD) System, which is used for Child Death Review (as well as for CHILD Profile, Health Start, and PRAMS). However, it was found that not all of the seven counties participated in ENCD electronic updates.

Case ascertainment and confirmation consisted of contacting health officials at county and state agencies to obtain verification of reported cases and seek unreported cases which met the case definition. During case confirmation, various data earlier reported were corrected (for example, two presumed infant deaths were actually fetal deaths), and missing data were obtained (for example, on residency).

Eight reported cases not meeting the case definition (all with published obituaries) were dropped from consideration in this investigation: five reported cases were not Cowlitz residents; two reported cases occurred outside the case definition time period; and, one reported case did not meet the legal Washington state definition of a fetal death, though a fetal death certificate was issued in Oregon. Three new cases, two fetal and one infant, were ascertained which were not reported via published obituaries. One case, reported by a local health agency, was subsequently dropped from consideration because it did not meet the residency criterion in the case definition. One case, reported by Oregon Health Division, was subsequently re-classified as a non-case after an error in the reported date of death was discovered.

## Data analysis

Data analysis consisted of comparison of the observed number of deaths to the expected number of deaths, using the following method. A "Poisson 95% Confidence Interval" is created around the observed number. This Confidence Interval (CI) is an indicator of the uncertainty which is found when small numbers are examined. This statistic is then compared to the expected number. If the expected number falls outside the range around the observed number, then we label the result "statistically significant" and we conclude that the observed number differs from that expected. If the expected number falls inside the range around the observed number, then we label the result "not statistically significant" and we conclude that the observed number does not differ from that expected.

At the conclusion of case ascertainment and confirmation, four infant deaths and five fetal deaths were found to meet the case definition. When all of the nine perinatal deaths were considered together, the case series constituted a statistically significant cluster. Data analysis of the perinatal deaths found a 95% CI around the observed number to be 4.1 to 17, a range which did not include the expected number of 3.9. The ratio of observed to expected (O/E) was 2.3, which is a modest elevation. The team concluded that this elevation could be best understood by separate analysis of the infant and fetal deaths.

Data analysis of the four infant deaths found a 95% CI around the observed number to be 1 to 10, a range which included the expected number of 2.6; thus, this elevation was not statistically significant. The O/E ratio was 1.5, which is a small elevation. The team concluded that the number of observed infant deaths for the period did not exceed that expected, and closed that portion of the investigation.

Data analysis of the five fetal deaths, however, found a statistically significant elevation. The 95% CI around the observed number was 1.6 to 11, a range which did not include the expected number of 1.3. The O/E ratio was 3.8, which is a substantial elevation. The team concluded that the number of observed fetal deaths for the period did exceed that expected, and thus, as previously decided, returned to the case definition stratification method.

Information on the estimated gestational age of the fetal deaths was obtained, and it was found that of the five fetal death cases, three were in the category of 20-27 weeks gestation. For these three cases, the 95% CI around the observed number was 0.6 to 8.4, a range which did include the expected number of 0.63, and the O/E ratio was 4.7, which was not statistically significant. The team concluded that the number of observed fetal deaths in the category of 20-27 weeks gestation for the period did not exceed that expected, and inferred that the known fluctuations in reporting were most likely responsible for the apparent increase.

For the two fetal death cases in the category of 28+ weeks gestation, the Poisson 95% CI around the observed number was 0.2 to 7, a range which did include the expected number

of 0.6, and the O/E ratio was 3.3, which was not statistically significant. The team concluded that the number of observed fetal deaths in the category of 28+ weeks gestation for the period did not exceed that expected. The team inferred that the apparent increase over expected was most likely due to normal variation in annual occurrence.

Because the number of observed cases did not clearly exceed the number of expected cases, the cluster investigation team did not progress to further examination of case information, such as to seek any common links which might be found in the cause of death information. Fetal death certificates have been found, in research studies focusing on data quality, to be incomplete and, in some cases, not entirely accurate. Thus, such examination of cause of death information on the certificates for these nine cases was judged by the team to be unlikely to yield useful information, especially when based on such a small number of cases.

Place of residence was examined for the nine cases, to determine whether any common links could be found on a geographical basis. Although all cases resided in Cowlitz County by definition, there was no geographic clustering within the county. Three cases resided in Longview, three in Kelso, and one each in Castle Rock, Toledo, and Woodland.

### **Conclusions and recommendations**

There are a wide range of determinants of health in general, and reproductive health in particular: genetics, behavioral, environmental, and health services. When research is done to uncover new or unknown causes of ill health, it is necessary to “hold constant” all of the other possible causes in order to examine any one possible cause. For this reason, the studies of causes generally need large numbers of cases to find useful results. Studies of cases series with small numbers virtually never find any identifiable cause. For example, a review of 22 years of cancer cluster investigations at the federal Centers for Disease Control and Prevention (CDC) concluded that “no clear cause was found for any cluster.”

In this investigation of Cowlitz perinatal deaths, the cluster investigation team concluded that the apparent elevations in infant and fetal deaths, seen with examination of the published obituaries, were understandable in terms of variation due to known factors: normal variation in annual occurrence, and known fluctuations in reporting of early fetal deaths.

However, the fact that all perinatal deaths, when considered together, were elevated over that expected, did lead the team to recommend further monitoring of these reproductive outcomes. This monitoring will include, but not be limited to, subsequent examination of the occurrence of perinatal deaths during the second three months of 1999. This follow-up study is planned to commence in mid-August. If the findings are similar to that seen in the first three months of 1999, then the team will obtain death certificates for all six months of cases, and examine the information, such as cause of death, on the certificates.

The cluster investigation team also recommended continuation of the formation and development of the Cowlitz County Child Death Review Team. When fully implemented, this process may be well positioned for early detection of clusters, and able to identify possible preventive interventions.

Finally, the cluster investigation team also recommended continuation of the community programs aimed at improving and promoting healthy pregnancies. There is much that individuals and communities can do to promote healthy mothers and healthy babies, and this work is an essential foundation for the health of the public.

*Date of report:* 14 July 1999.

EDITORIAL NOTE: This report is a minor revision of the report completed 22 June 1999. Subsequent to the issuance of that report, DOH was informed by Oregon Health Division that a date of delivery was incorrect on one reported case, which caused it to fall outside the case definition time period for date of occurrence: it had been reported as 2/2/1999, but was actually 4/2/1999. As a result, the count of cases was revised downward from ten to nine, and computations for the data analysis were recalculated. Overall, removal of the incorrectly counted case strengthened the scientific inferences. Reducing the count of observed cases had the effect of reducing the O/E ratios, which reduces the level of concern about whether there was an actual cluster. However, because the nine perinatal death cases, when considered together, are still more than expected, concern remains, and the recommendations for continued monitoring are still supported by the data. Likewise, the five fetal death cases, when considered together, are still more than expected, and concern remains focused there. There was, therefore, no change in any of the conclusions or recommendations in the report.

## Infant mortality rate, WA residents

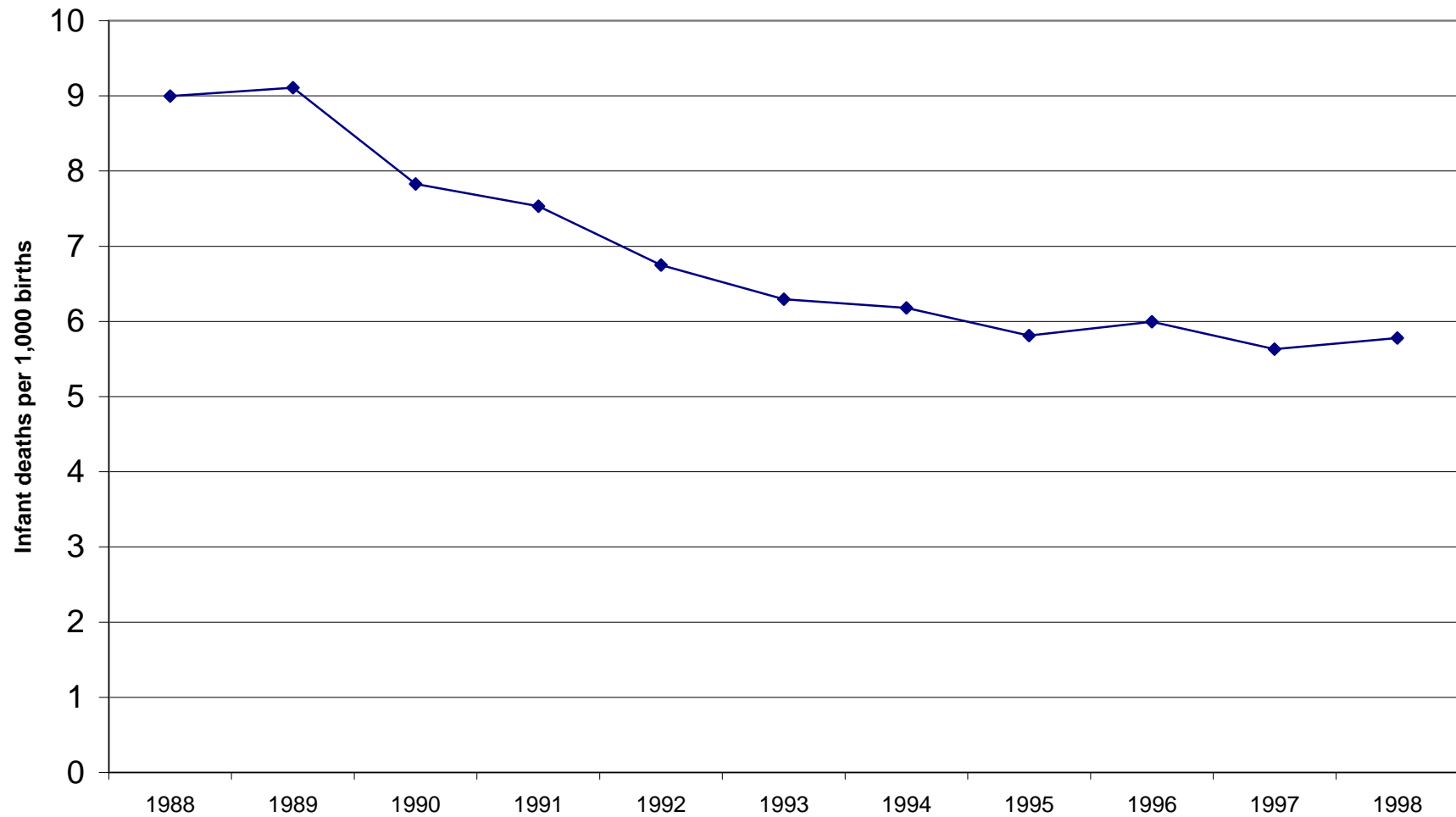


Figure 1. Infant mortality rate, Washington residents, 1988-98. Data Source: Washington State Department of Health, Center for Health Statistics.



## Fetal death ratio, WA residents

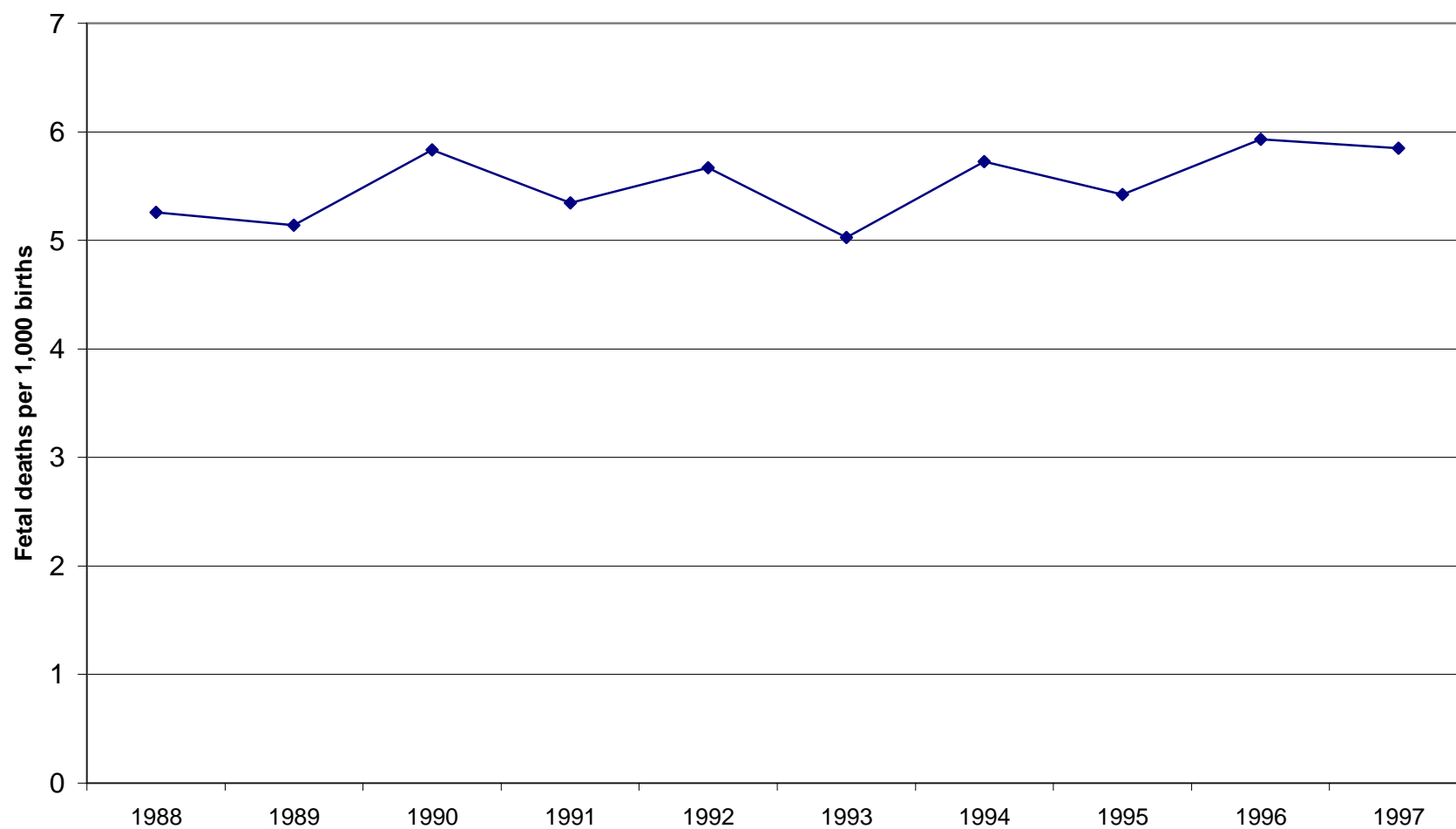


Figure 2. Fetal death ratio, Washington residents, 1988-97. Data source: Washington State Department of Health, Center for Health Statistics.

## Infant deaths, Cowlitz residents, 1988-98

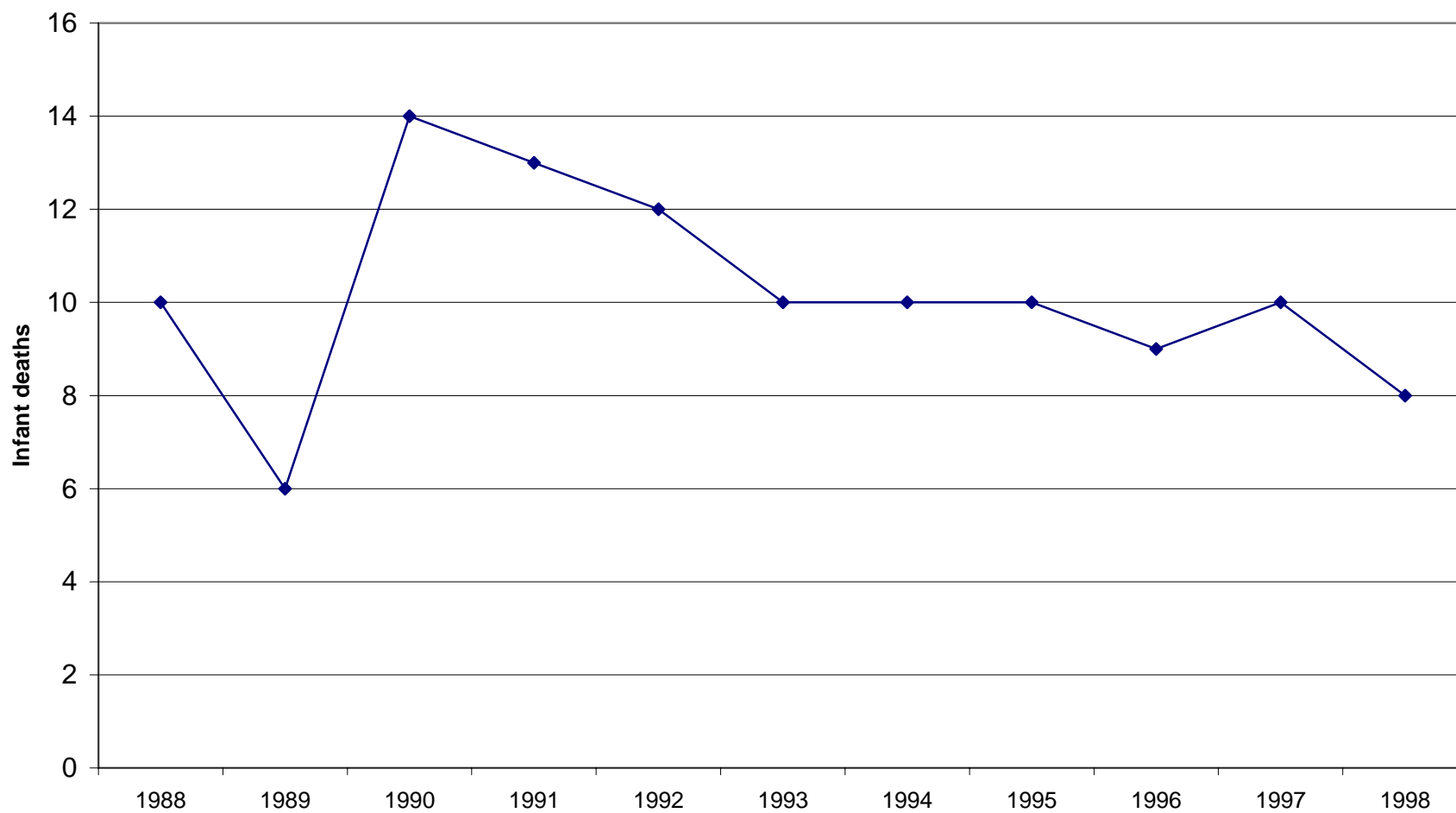


Figure 3. Infant deaths, Cowlitz County residents, 1988-98. Data source: Washington State Department of Health, Center for Health Statistics.

## Fetal deaths, Cowlitz residents, 1988-97

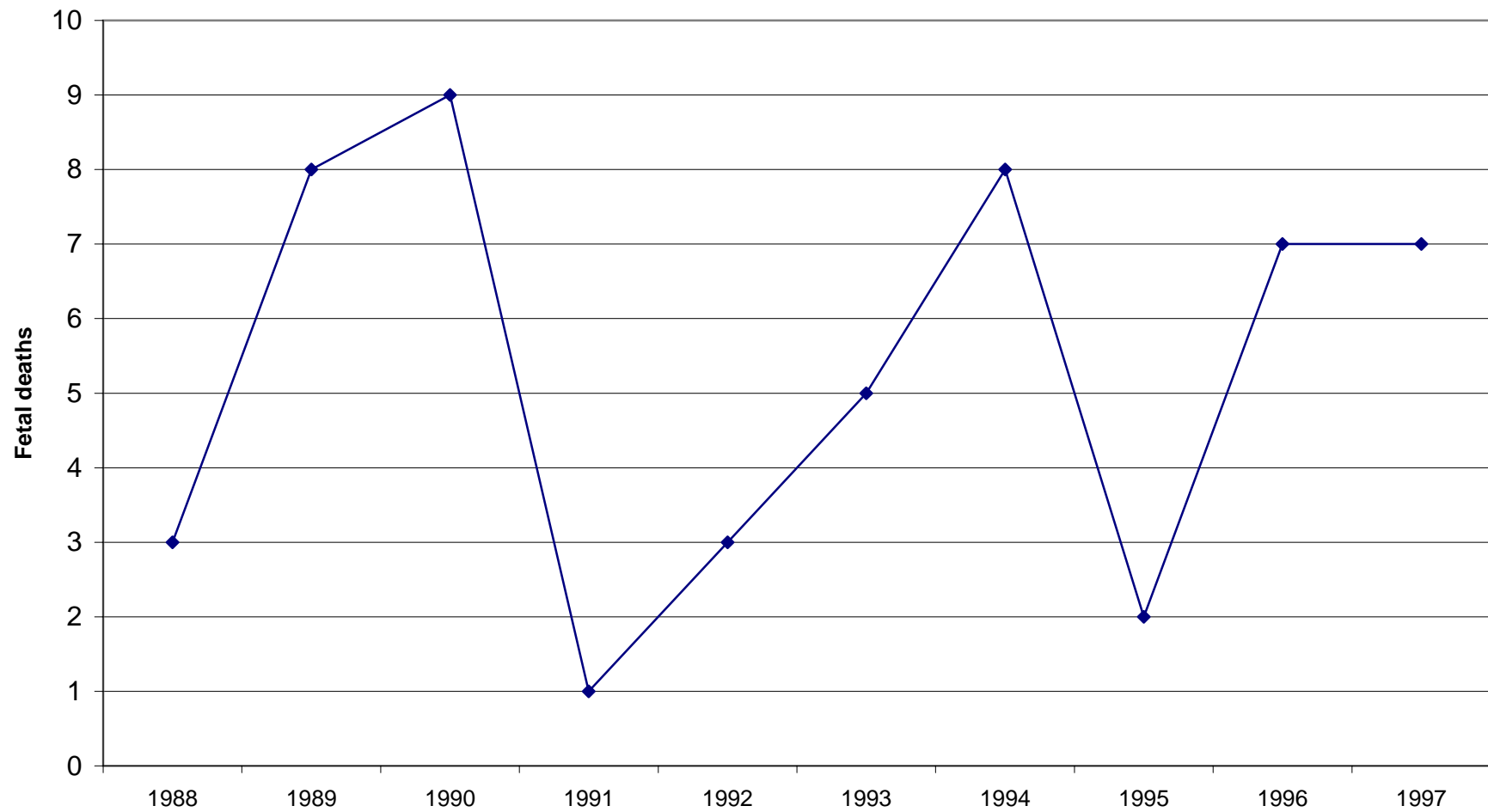


Figure 4. Fetal deaths, Cowlitz County residents, 1988-97. Data source: Washington State Department of Health, Center for Health Statistics.